

Assignment 4

Textbook Assignment: "Air Masses and Fronts" (continued); "Atmospheric Phenomena. "
Pages 4-3-1 through 5-1-6.

Learning Objective: Describe slow-moving cold fronts, fast-moving cold fronts, secondary cold fronts, and cold fronts aloft.

- 4-1. What is the average slope of a slow-moving cold front?
1. 1:50
 2. 1:100
 3. 1:150
 4. 1:300
- 4-2. Which of the following indications is representative of the passage of a slow-moving cold front?
1. Wind backs
 2. Sharp rise in pressure
 3. Marked temperature rise
 4. Sharp drop in the dewpoint
- 4-3. What is the average range of speed of a slow-moving cold front?
1. 5 to 10 knots
 2. 10 to 15 knots
 3. 15 to 20 knots
 4. 20 to 25 knots
- 4-4. When the cold air to the rear of a slow-moving cold front is moist and stable, and the warm air that it is displacing is also moist and stable, which of the following weather conditions is most likely to occur in the vicinity of the front?
1. Thunderstorms at and ahead of the front
 2. Thunderstorms at and behind the front
 3. Rapid clearing with the frontal passage
 4. low ceilings of stratus and fog
- 4-5. Which of the following statements describes a characteristic of slow-moving cold fronts?
1. The frontal inversion is usually very evident
 2. Isotherms parallel the front and are concentrated in the cold air
 3. Cloudiness and precipitation normally extend back into the cold air as far as the wind and isotherms parallel the front
 4. Each of the above
- 4-6. The winds that push a slow-moving cold front are more parallel to the front at lower levels than aloft.
1. True
 2. False
- 4-7. Where do squall lines develop?
1. In advance of a slow-moving cold front
 2. To the rear of a slow-moving cold front
 3. In advance of a fast-moving cold front
 4. To the rear of a fast-moving cold front
- 4-8. Which of the following factors determines the type of weather associated with a fast-moving cold front?
1. The moisture content of the cold air only
 2. The stability of the cold air only
 3. The moisture content and stability of the cold air
 4. The moisture content and stability of the warm air
- 4-9. A fast-moving cold front has an average range of speed of
1. 15 to 20 knots
 2. 20 to 25 knots
 3. 25 to 30 knots
 4. 30 to 35 knots

- 4-10. Which of the following indications is/are associated with the passage of a fast-moving cold front?
1. The dew point changes little if at all
 2. The temperature changes little, if at all, until the front is well past
 3. Rapid clearing
 4. Answers 2 and 3 are both correct
- 4-11. Which of the following upper air characteristics is associated with the passage of a fast-moving cold front?
1. Slight backing of the wind with height
 2. A double inversion; the frontal inversion and a subsidence inversion some distance to the rear of the front
 3. Isotherms are well spaced and cross the front at an angle of about 30 degrees
 4. Each of the above
- 4-12. What is a secondary cold front?
1. A fresh outbreak of very cold air to the rear of a fast-moving cold front
 2. A trough of low pressure
 3. The classification given to any summertime cold front
 4. Any cold front that is classified as unimportant meteorologically
- 4-13. Which of the following occurrences leads to the formation of a cold front aloft?
1. The mP air to the rear of a cold front crosses a mountain range and rides atop warm moist mT air
 2. Cool air overtakes colder more dense air and rides up over it
 3. Cold dense air overtakes cooler less dense air and forces it aloft
 4. Each of the above
- 4-14. A squall line is an instability line, but an instability line is NOT necessarily a squall line.
1. True
 2. False
- 4-15. Which of the following statements concerning prefrontal squall lines is correct?
1. They form about 50 to 300 miles in advance of fast-moving cold fronts
 2. Their speed is roughly equal to 40% of the 500-mb wind speed
 3. They are most common in spring and summer in the United States
 4. Each of the above
- 4-16. Which of the following weather changes occurs with the passage of a prefrontal squall line?
1. The temperature rises significantly
 2. The pressure falls
 3. The wind shifts cyclonically
- 4-17. What air mass(es) is/are involved in the development of Great Plains squall lines?
1. mT only
 2. mT and mP
 3. mT and cP
 4. mP and cP
-
- Learning Objective: Describe the characteristics and weather of warm fronts at the surface and aloft.
-
- 4-18. What is the average speed of warm fronts?
1. 5 to 10 knots
 2. 10 to 20 knots
 3. 15 to 25 knots
 4. 20 to 30 knots
- 4-19. In the Northern Hemisphere, how are the surface winds affected before and after the passage of a warm front?
1. They are generally southeasterly ahead of the front and shift to southwesterly after passage
 2. They are strongest after passage
 3. They shift in a counterclockwise direction
- 4-20. Where is nimbostratus and its accompanying precipitation most frequently found in relation to the warm front?
1. Within 300 miles of the front in the cold sector
 2. Within 300 miles of the front in the warm sector
 3. 500 miles in advance of the front
 4. 500 miles to the rear of the front
- 4-21. What is produced when the winds perpendicular to a warm front increase with height?
1. Strong overrunning of the warm air across the top of the retreating cold air mass
 2. Pronounced prefrontal cloudiness
 3. Precipitation
 4. Each of the above

4-22. When overrunning occurs, and the air is moist and unstable, which of the following weather phenomena occurs?

1. Clear skies
2. High and mid clouds only
3. Stratus and fog
4. Thunderstorms

4-23. When a warm front crosses a mountain range and encounters colder air on the lee side of the mountain, which of the following phenomena may occur?

1. The warm front moves across the top of the cold air as an upper warm front
2. Overrunning
3. Inversions are wiped out
4. Each of the above

Learning Objective: Describe the formation, structure, and characteristics of occluded fronts.

4-24. Occluded fronts are classified as which of the following types?

1. Cold only
2. Warm only
3. Cold or warm.
4. Cold, warm or cool

4-25. What is the primary difference between a warm and cold occlusion?

1. The temperature of the warm air
2. The temperature of the cold air
3. The temperature of the cool air
4. The location of the associated upper front in relation to the surface front

4-26. Which of the following occurrences takes place in the cold-occlusion process?

1. Cold air displaces the warm air to the rear of a warm front and then undercuts the relatively cooler air in advance of the warm front
2. Cool air displaces the warm air to the rear of a warm front and then rides up over the colder retreating air ahead of the warm front
3. Warm air displaces the cold air in advance of the warm front and rides up over cool air behind the cold front
4. Cold air replaces warm air and then overruns relatively cooler air ahead of the warm front

4-27. How is a cold occlusion designated that crosses the Rocky Mountains and encounters deep, cold air over the Plateau or Western Plains?

1. As an occlusion
2. As a cold front
3. As an upper cold front
4. As a warm front

4-28. Where does MOST of the precipitation occur with a cold occlusion?

1. Ahead of the occlusion, if the occlusion is old
2. To the rear of the occlusion in the occlusion's initial stages of development
3. Just ahead of the occlusion
4. Just to the rear of the occlusion

4-29. How are the isotherms affected as an occlusion matures?

1. They become more parallel to the occlusion on the cold air side
2. They become more parallel to the occlusion on the warm air side
3. They become more perpendicular as they cross the front
4. Warm and cold pockets form, and no isotherms cross the front

4-30. Which of the following situations is conducive to the formation of a warm occlusion?

1. The presence of a cPk air mass in the Gulf of Mexico
2. The invasion of mPk air into the Great Plains
3. The presence of cPk air over Canada, a warm front along its western periphery, and an approaching mPk air mass
4. The development of a low at the southern tip of the Appalachian Mountains

4-31. Where are the pressure falls associated with a warm occlusion located?

1. In advance of the upper warm front
2. In advance of the occlusion's surface position only
3. In the pressure trough behind the occlusion
4. In advance of the upper cold front and the surface occlusion

- 4-32. In a warm occlusion, where is the most severe weather located?
1. At the apex during the developmental stage
 2. At the point where the warm air is at its highest altitude
 3. In the warm sector equatorward of the apex of the occlusion
 4. At the northernmost extension of a mature occlusion

Learning Objective: Describe the characteristics of stable and unstable quasi-stationary fronts.

- 4-33. The wind shift across a quasi-stationary front is on the order of how many degrees?
1. 45
 2. 90
 3. 135
 4. 180
- 4-34. Which of the following statements is true concerning the winds above the friction level over a quasi-stationary front?
1. They parallel the front
 2. They are more or less perpendicular to the front
 3. They are non-existent
 4. They parallel the front in the warm air only
- 4-35. The weather along a quasi-stationary front is dependent on which of the following conditions?
1. The steepness of the frontal slope
 2. The stability of the warm air
 3. Undulations of the front toward the warm air
 4. All of the above conditions
- 4-36. Which, if any, of the following types of weather is associated with a quasi-stationary front when stable, warm air is advected up a steep frontal slope?
1. Tornadoes
 2. Thunderstorms
 3. Embedded showers
 4. None of the above

- 4-37. The most violent weather associated with quasi-stationary fronts occurs when
1. stable warm air is advected up a steep frontal slope
 2. unstable warm air is advected up a shallow frontal slope
 3. unstable warm air is advected up a steep frontal slope
 4. stable warm air is advected up a shallow frontal slope

Learning Objective: Describe how fronts are modified by their movement, orographic features, and underlying surfaces.

- 4-38. Which, if any, of the following effects of frontal speed on weather is correct?
1. Fast-moving fronts usually produce the most violent weather
 2. The return to favorable weather conditions takes place much quicker with a slow-moving front
 3. A front whose speed is erratic creates varying weather conditions, and is much easier to forecast
 4. None of the above
- 4-39. Which of the following aspects of a front is affected by mountain ranges?
1. Speed
 2. Slope
 3. Weather
 4. Each of the above
- 4-40. With regard to precipitation, a cold front that approaches and crosses a mountain range will generally
1. show a decrease in precipitation intensity
 2. have its area of precipitation narrowed
 3. produce greater amounts of precipitation on the leeward side
 4. produce greater amounts of precipitation on the windward side

4-41. Which of the following occurrences takes place when a warm front encounters a mountain range?

1. The warm air above the frontal surface is mechanically lifted producing severe thunderstorms
2. The frontal slope is drastically changed at higher altitudes
3. The front becomes more or less stationary on the leeward side
4. The cold air beneath the frontal surface gets cut off on the windward side

4-42. Mountain ranges prolong warm frontal precipitation and widen the precipitation area.

1. True
2. False

4-43. Which of the following statements concerning skagerraking and occlusions is correct?

1. Skagerraking occurs most frequently on the west coast of mountainous continents
2. The new low develops very rapidly
3. Skagerraking can occur with either cold or warm occlusions
4. Each of the above

4-44. When an air mass leaves its source region, it may be modified by the underlying surface in which of the following manners?

1. Moisture may be added and taken away
2. Temperatures may be increased or decreased
3. Frontal characteristics may be completely destroyed
4. All of the above

4-45. In the western Atlantic and Pacific Oceans, cold fronts of fall and winter are of greater concern to shipping than at other times of the year. Why?

1. Air mass contrast is magnified thereby producing more severe weather
2. Gale force winds are common in the cold air to the rear of these fronts
3. Low pressure systems are often spawned and develop over the warm northerly flowing waters of these regions
4. All of the above are reasons

Learning Objective: Identify the characteristics of hydrometeors.

4-46. Which of the following is NOT a hydrometer?

1. Rain
2. Rainbow
3. Drizzle
4. Spray

4-47. To be classified as rain, the water droplets that reach the Earth's surface will have a diameter of

1. .001 to .01 inch
2. .005 to .02 inch
3. .010 to .02 inch
4. .020 inch and greater

4-48. How is precipitation that falls from convective clouds classified?

1. Rain
2. Snow
3. Showery
4. Steady

4-49. Which of the following hydrometers appears as a fine mist, floats rather than falls through the air, and is frequently accompanied by fog and restricted visibilities?

1. Light rain
2. Snow
3. Drizzle

4-50. Which of the following hydrometers is considered to be the frozen equivalent of drizzle?

1. Snow grains
2. Snow pellets
3. Ice pellets
4. Ice crystals

4-51. What is another name for sleet?

1. Snow grains
2. Snow pellets
3. Ice pellets
4. Ice crystals

- 4-41. How, if at all, does sleet differ from small hail?
1. Sleet rebounds on striking the ground, hail does not
 2. Sleet is composed of snow encased in an ice layer, and hail is the exact opposite
 3. Sleet is a continuous type of precipitation, while small hail is showery
 4. They are both ice pellets and do not differ

- 4-53. Hail forms in what type of cloud?

1. Cumulus mediocris
2. Altocumulus castellanos
3. Nimbostratus
4. Cumulonimbus

- 4-54. Which of the following hydrometers is common in polar regions and mainly visible in sunlight?

1. Ice prisms
2. Ice pellets
3. Snow pellets
4. Snow grains

- 4-55. What occurs when water droplets in a cloud evaporate and then sublimate directly onto ice crystals within the cloud?

1. The ice crystals always melt
2. Precipitation begins
3. Nothing until the ice crystals melt, then the original droplets will have grown in size
4. Turbulence

- 4-56. In order for water vapor to condense and form clouds, which of the following conditions is NOT necessary?

1. Sufficient moisture
2. Hygroscopic or sublimation nuclei
3. Turbulent air currents
4. A cooling process

- 4-57. Why are hygroscopic and sublimation nuclei so important in the cloud formation process?

1. They determine the type of cloud that will form
2. Cloud formation is all but impossible without them
3. They trigger the precipitation process
4. All of the above are reasons

- 4-58. What clouds are believed to be the result of direct sublimation?

1. Cirriform
2. Stratiform
3. Cumuliform
4. Nacreous

IN ANSWERING QUESTIONS 4-59 THROUGH 4-61, MATCH THE CLOUD FORMATION TERMS FROM COLUMN B WITH THE DEFINITIONS LISTED IN COLUMN A.

A. DEFINITIONS

B. TERMS

- 4-59. Cooling brought about by orographic or frontal lifting of air

1. Hygroscopic nuclei

- 4-60. Very small minute particles with an affinity for water

2. Accretion
3. Mechanical cooling

- 4-61. The accumulation of ice crystal layers brought about when super-cooled water droplets collide with ice crystals

-
- 4-62. What are the upper limits of cirriform clouds (based on etage classification) in the tropics, middle latitudes, and polar regions?

1. 80,000, 45,000, and 25,000 feet
2. 60,000, 45,000, and 25,000 feet
3. 60,000, 30,000, and 16,600 feet
4. 20,000, 16,500, and 10,000 feet

- 4-63. Which of the following clouds is classified as belonging to one etage but may extend into other etages?

1. Altocumulus
2. Altostratus
3. Nimbostratus
4. Stratus

IN ANSWERING QUESTIONS 4-64 THROUGH 4-67, MATCH THE CLOUD GENERA IN COLUMN B WITH THE DEFINITIONS LISTED IN COLUMN A.

<u>A. DEFINITIONS</u>	<u>B. CLOUD GENERA</u>
4-64. Fibrous blue or gray veil or sheet	1. Cirrocumulus
4-65. Thin whitish veil that often produces halos	2. Cirrostratus
4-66. Small white globular masses that resemble balls of cotton	3. Altocumulus
4-67. Flattened globular masses that appear in lines, groups, and waves	4. Altostratus

4-68. The cloud species castellanus applies mainly to which of the following cloud genera?

1. Cumulus
2. Stratus
3. Altocumulus
4. Cirrus

4-69. A cumulonimbus cloud that produces hanging pouchlike protuberances is known as

1. tuba
2. castellanus
3. mammatus
4. congestus

4-70. Elongated cloud masses in the shape of lenses or almonds are classified as

1. humilis
2. stratiformis
3. fractus
4. lenticularis

4-71. The fair weather cumulus clouds of the tropics have little vertical extent and are classified as

1. humilis
2. mediocris
3. fractus
4. castellanus